Issued May 10, 1915.

U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN 530.

IMPORTANT POULTRY DISEASES.

BY

D. E. SALMON, D. V. M.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1913.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., March 6, 1913.

SIR: I have the honor to transmit herewith, and to recommend for publication as a Farmers' Bulletin, a treatise by Dr. D. E. Salmon on "Important Poultry Diseases."

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

CONTENTS.

IMPORTANT POULTRY DISEASES.

INTRODUCTION.

Fowls are liable to be affected by a considerable number of diseases, some of which spread rapidly through the flock and kill a large part of the birds. They may also be infested by various kinds of parasites, some of which live on the surface of the body and others in the crop, stomach, or intestines. These parasites are injurious because they take a part of the nourishment which should be used by the bird to put on flesh or to produce eggs, and also because by their movements and their biting they cause irritation and inflammation of the parts which they attack.

The contagious diseases, which are caused by animal and vegetable germs, and the weakness and loss of flesh caused by the larger parasites to which reference has just been made, are the most important conditions which the poultryman has to consider in the endeavor to keep his birds in a healthy condition. These germs and parasites should be kept out of the flock by suitable preventive measures, because disease may be avoided in this way much more easily and cheaply than it can be cured. The aim in studying the diseases of birds is, therefore, to learn how to prevent such diseases rather than how to cure them.

There are some cases in which medicines may be advantageously given or applied to fowls, but as a rule when a bird becomes sick it is better to kill it, because the cost of the medicine and the value of the time required to carry out the treatment are greater than the value of the birds which are cured. Another reason for killing sick birds is that they may be affected by a contagious disease which before it is recognized may spread to many other birds in the flock. A third reason for killing is the fact that a bird being sick indicates that it is more susceptible to disease than the other birds of the flock, and in order to establish a flock which is able to resist disease such susceptible birds must be weeded out.

The greater the number of birds which are kept upon any farm or plot of ground, and the more they are crowded together, the greater is the danger from contagion and parasites, and the more important are the measures for excluding, eradicating, and preventing the development of these causes of disease.

HOW TO PREVENT DISEASE.

It is very important to start right and begin the flock with birds which are free from contagion and parasites, and to put such birds upon ground which is likewise free from these causes of disease.

The best way to accomplish this is to get eggs from a flock which has shown no indications of contagious disease for at least a year; avoid putting these eggs in any packing such as chaff, oats, or cut straw which may be musty or moldy; wipe the eggs with a cloth wet in 70 to 80 per cent alcohol, and hatch them in a new or thoroughly cleaned incubator. The young chicks should be free from parasites and injurious germs of all kinds, and, to keep them in this condition, they should be put in new or clean brooders and permitted to run only upon ground where poultry has not previously been kept or which has not been used for poultry for several years.

Sometimes these directions can not be followed in all respects. If all the available ground has been recently used for poultry, the fowls should be removed from that part which is to be used for the new flock, a good coating of freshly slaked lime should be applied to the entire surface of the ground, and a few days later it should be plowed. It may now be cultivated three or four times with intervals of a week and finally sowed with oats, rye, or other grain. In a few months the greater part of the germs will be destroyed, but it is best to leave the ground unoccupied by fowls until a winter has passed, as the freezing and thawing of fall and spring is more effective than either continued cold or warm weather.

If the eggs must be hatched under hens instead of in the incubator, the problem of starting a clean flock is much more difficult. Hens are liable to harbor parasitic worms in their intestines and to scatter the eggs of these worms with their manure wherever they go. They generally have lice and mites hidden in their feathers, which pass to the young chicks immediately after the latter are hatched; and they may be the carriers of disease germs even when they appear perfectly healthy. For these reasons the hens which are used for hatching should be selected from a flock that is known to have been free from other diseases than those caused by accidents for at least a year, and the individual birds of which are lively, vigorous, free from lice and mites, and producing a large number of eggs.

The hens selected for hatching should be well dusted with a good lice powder before they are given a setting of eggs; their nests should be perfectly clean and should be made with fresh, soft hay or straw; and there should be a box of road dust, or sifted hard-coal ashes or similar substance, under cover, where they can dust themselves whenever they come from the nest. When the young chicks are taken from the nest they should be carefully examined for lice. These parasites

usually accumulate under the throat and upon the top and back of the head. If any are found, rub a little sweet oil, pure lard, or vaseline with the finger over the parts where the lice are. This kills the lice by obstructing their breathing pores and does not harm the chicks.

By beginning in this manner, a flock may be obtained which is practically free from disease germs and parasites, but in order to keep it in this condition the premises must be frequently cleaned and occasionally disinfected. There are a number of reasons for this. First, there are certain germs generally present in the intestines of healthy fowls and that are scattered with the manure, which when they are permitted to accumulate and become very numerous may cause outbreaks of disease; secondly, the germs of contagious diseases may be brought to the poultry yard by pigeons or other birds which fly from one poultry yard to another, or by mice or rats; thirdly, it is seldom that grounds are obtained for the poultry yard which are entirely free from infection with the eggs of parasitic worms and the spores of disease-producing microbes. To keep these germs and parasites from developing and increasing their numbers to a dangerous extent, the houses should be kept clean, the drinking fountains and feed troughs should be washed every day or two with boiling water or other disinfectant, and, if any lice or mites are found on the birds or in their houses, the roosts and adjoining parts of the walls should be painted with a mixture of kerosene, 1 quart, and crude carbolic acid or crude cresol, 1 teacupful (1 gill). Or the house may be whitewashed with freshly slaked lime or sprayed with kerosene emulsion. The fowls should be dusted every three or four days with lice powder until these parasites entirely disappear, which should be within two weeks, if these measures are properly applied.

LICE POWDERS AND THEIR APPLICATION.

Very good lice powder may be made at little cost by mixing fine road dust, 2 quarts, and tobacco dust, 1 pint. In place of road dust, anthracite coal ashes well sifted may be used, and Persian insect powder or flowers of sulphur may be substituted for the tobacco dust. The important point is that all the ingredients should be in the form of a very fine dust.

A powder much recommended is made by mixing 3 parts gasoline and 1 part crude carbolic acid (90 to 95 per cent pure) and adding to this mixture slowly, while stirring, enough plaster of paris to take up all the moisture. It takes about 4 quarts of plaster of paris to 1 quart of the liquid. When enough plaster is added the mixture should form a dry, brownish powder. Those who make this powder should remember that gasoline is very inflammable and may cause an explosion if there is any fire near; also that crude carbolic acid of

this strength may burn the hands, face, or eyes if it comes in contact with them.

Lice powders are best applied by putting them into a tin can having a perforated top like a pepper box, but with larger holes. A newspaper is spread on the floor to catch the surplus powder, the fowl is held by the legs, head downward, so that the feathers will loosen up and fall away from the body, and then the powder is dusted thoroughly through the feathers, especially under the tail and wings and about the neck and head. By rubbing the feathers slightly with the hand the powder will penetrate and form a coating over the skin, which is destructive to both lice and mites.

It is possible and practicable to keep a flock of poultry absolutely free from lice and mites, and this should be the aim of everyone who is endeavoring to establish a successful poultry industry.

DISINFECTANTS AND THEIR APPLICATION.

Good disinfectants destroy the germs of contagious diseases, the external parasites such as lice and mites, and the embryos of the intestinal worms. They should be thoroughly applied to the interior of the houses, worked into all the cracks and crevices, spread over the ceiling and the floor, the roosts, dropping boards, and nest boxes. At the same time, the feeding and drinking troughs should be disinfected by pouring boiling water into them and afterwards drying them in the sun. The disinfectants are most easily applied to the walls and ceilings with a spray pump or brush. As it is difficult to keep them from coming into contact with the face and hands, the more harmless of these mixtures should generally be used. Ordinarily limewash made from freshly slaked lime is excellent and its properties are well known to all. In the case of an actual outbreak of virulent disease, it is well to add to the limewash 6 ounces of crude carbolic acid to each gallon, to increase its activity as a disinfectant.

The kerosene emulsion which is frequently used to destroy lice and mites may readily be converted into a disinfectant. To make the emulsion shave ½ pound of hard laundry soap into ½ gallon of soft water and boil the mixture until all of the soap is dissolved, then remove it to a safe distance from the fire and stir into it, at once, while still hot, 2 gallons of kerosene oil. This makes a thick, creamy emulsion, or stock mixture. When it is to be used for killing lice in the houses 1 part of this emulsion is mixed with 10 parts of water. When it is to be used as a disinfectant add 1 quart of emulsion to 10 quarts of water and stir well; then add 1 pint crude carbolic acid or crude cresol and again stir until all is well mixed.

One of the best disinfectants is the compound solution of cresol, which may be purchased ready for use. It contains 50 per cent of cresol, and 1 pint of it added to 10 quarts of water makes a solution

of the proper strength to apply to the houses or to spray over the ground. A 5 per cent solution of carbolic acid (1 pint carbolic acid to 10 quarts of water) is about equally efficacious. The choice between the two is a matter of convenience.

CHOLERA AND CHOLERA-LIKE DISEASES.

There are several diseases which have been investigated and described as different because the bacteria which cause them differ in some of their characteristics. The symptoms and the changes which are seen after death are so nearly identical that it is only by studying the bacteria that any one of these diseases can be distinguished from the others. The treatment applicable to one is equally applicable to the others. For the practical purpose of combating them in the poultry yard we may therefore group these diseases together.

Causation.—There are certain germs (bacteria) which are nearly always found in the intestines of healthy fowls which have more or less power to produce disease, but which the sound, healthy fowl is able to resist under favorable conditions. If these germs are inoculated into canary birds, they produce a fatal disease, because the canary does not have the power to resist them. If inoculated from one canary to another three or four times, these germs have their disease-producing powers so increased that they are able to kill adult fowls. When the resisting powers of fowls are diminished by exposure to cold, hunger, thirst, and exhaustion, as occurs during long shipments by rail, these germs may also cause disease in the fowls. In some countries the sickness which develops from these conditions is called "the transportation disease."

It sometimes happens that this disease develops in poultry yards which are not kept clean, possibly because of the large numbers of these germs which are taken into the bodies of the birds, but probably because they have acquired greater disease-producing powers from growing in warm manure. When they begin growing in the tissues of fowls they soon increase their virulence, and the disease which they cause may rapidly spread from fowl to fowl until the greater part of the birds are dead.

The typical germ of fowl cholera has adapted itself more completely than have these common germs to the conditions of life within the fowl's body, so that it is strictly parasitic, and is only obtained from fowls which are affected or have been affected with the disease. That is, birds only contract true fowl cholera by exposure to contagion that originates in other birds that have or have had the disease.

The cholera-like diseases may, therefore, either develop in the poultry yard from insanitary conditions, or they may be introduced

by contagion carried by new birds which are added to the flock, by birds which have been to exhibitions, by wild birds which fly from one poultry yard to another, or by various animals, such as dogs, cats, rats, etc. Birds which recover from the disease may sometimes carry the germs and disseminate the contagion for six months or a year after they are apparently well.

Symptoms.—The first symptom is a yellowish coloration of that part of the excrement which is secreted by the kidneys and which in health is nearly or perfectly white. Soon there is diarrhea, the droppings consisting of the whitish or yellowish secretions of the kidneys mixed with considerable thin mucus and a small quantity of intestinal contents which may have a yellowish, brownish, or greenish color. There is considerable fever, and soon after the bird is attacked it loses its lively appearance, separates itself from the flock, and appears dull, dejected, and sleepy. It no longer searches for food, but sits with the head drawn down to the body or turned backward and resting in the feathers about the wing. The plumage soon loses its brilliance, the wings droop, the appetite is diminished, and the thirst increased; the comb and wattles may be a dark bluish red from engorgement with poorly oxygenated blood, or they may be pale and bloodless on account of the congestion of the internal organs, especially the liver.

The affected birds soon become very weak, drowsy, and often sleep so soundly during the last day or two of their lives that it is difficult to arouse them. If made to move, they stagger forward for a few steps only in an uncertain manner and with dragging wings. The crop is generally distended with food and apparently paralyzed, and the feathers about the vent are soiled and sometimes pasted together with excrement.

As death approaches, the weight and the strength of the bird rapidly diminish, it breathes with difficulty, sits with the beak open, and the breathing may be heard at some distance. Finally the weakness is such that the beak is rested on the ground, and a little later the bird falls over on one side, makes a few convulsive movements, and dies.

In the very acute cases no symptoms are seen; the birds may be found dead under the roosts, or they may fall at the feed trough and die in a few minutes.

The cholera-like diseases often occur in a chronic form, which may follow an acute attack of the disease or may be chronic from the first. This form is characterized by a continually increasing weakness, loss of weight, bloodlessness, and, finally, an exhaustive diarrhea. Sometimes one or more joints of the wings or feet swell, the birds become very lame, and later the swellings break and discharge a creamy or cheesy mass which contains large numbers of the germs.

These diseases may destroy the greater part of a flock in a week and then disappear, or they may linger for months, only occasionally killing a bird. The time between exposure to the contagion and the appearance of symptoms is from 2 to 5 days, and the duration of the disease is from 24 hours to 10 days.

The most characteristic changes seen after death are red spots on the surface of the heart, which gives it the appearance of having been sprinkled with blood, congestion and enlargement of the liver, and swelling of the spleen.

Treatment.—The best method of treatment is to kill the sick fowls in such a way as not to spread the infection with their blood, burn or deeply bury their bodies, separate the remaining birds into small lots of 3 to 5 each, so that when a bird is attacked there will not be more than this number exposed to it; then watch each lot so as to remove any sick bird as soon as symptoms appear. Disinfectants should be used in the houses and yards where the disease first appeared, and also in the small pens in which the separated birds are kept.

If it is deemed advisable to treat the sick birds, they may be given 2 to 4 teaspoonfuls of a one-half per cent carbolic solution twice a day. This is generally made by adding 1 part of the 5 per cent solution to 9 parts of water. They should also be given buttermilk to drink.

Generally the best results are obtained by killing the sick birds and separating the well ones into small pens and giving to each one 2 doses of the carbolic acid solution daily for three or four days. The houses and yards should be thoroughly cleaned and disinfected before the fowls are returned to them, and should be kept very clean for some weeks afterwards to guard against a recurrence of the disease.

ROUP OR CONTAGIOUS CATARRH.

The disease called "roup" by poultrymen is a contagious catarrh, closely resembling the more malignant forms of influenza in the larger animals and in man. It attacks principally the membranes lining the eye, the sacs below the eye (infra-orbital sinuses), the nostrils, the larynx, and the trachea. It is attended with high fever and is very contagious.

Causation.—Roup appears to be a strictly contagious disease; that is, one which arises only, so far as known, by contagion from other diseased birds. The nature of the microbe which constitutes the virus is not known. The contagion is generally brought into the poultry yard by infected birds. Sometimes these are birds which are purchased from other flocks in which the disease exists; sometimes they are birds of the home flock which have been to exhibitions and there exposed to sick fowls; and sometimes they are wild birds or pigeons which fly from one poultry yard to another.

The saliva and the discharge which escapes from the nostrils carry the contagion, and soon contaminate the drinking water and feeding troughs so that all the fowls are infected. Even the flocks in adjoining yards are infected by the particles of mucus projected into the air when sneezing, or by the contagion carried on the feet of persons, animals, or small birds that pass from one yard to another.

Delicate birds are inclined to severe attacks and to recover slowly, and often a chronic condition persists for a long time. Birds so affected may carry and spread the contagion for a year or more and become the cause of new outbreaks of the disease.

Symptoms.—The symptoms first seen are very similar to those of an ordinary cold, but there is more fever, dullness, and prostration. The discharge from the nasal opening is at first thin and watery, but in two or three days becomes thick and obstructs the breathing. The inflammation, which begins in the nasal passages, soon extends to the eyes and to the spaces which exist immediately below the eyeballs (infra-orbital spaces). The eyelids are swollen, held closed much of the time, and may be glued together by the accumulated secretion. The birds sneeze and shake their heads in their efforts to free the air passages from the thick mucus. The appetite is diminished and the birds sit with their heads drawn in, wings drooping, and having a general appearance of depression and illness.

When the inflammation reaches the spaces or sacs beneath the eyes, it causes the formation of a secretion very similar to that of the nose, and as this becomes thick it collects, distends the walls of these spaces, and produces a warm and painful swelling, which is seen just below the eyes and may reach the size of a hickory nut. This swelling presses with much force on the eyeball, which is displaced and more or less deformed; and in extreme cases even the bones of the head may give way before it.

The closure of the eyes prevents the badly affected birds from finding food; the accumulation of mucus in the nostrils completely obstructs these passages, so that the beak must be kept open in order to breathe; the obstruction of the windpipe and the smaller air tubes causes loud breathing sounds and difficult respiration.

In the severe and advanced cases the birds sit in a somnolent or semiconscious condition, unable to see or to eat; their strength is rapidly exhausted, and many of them die within a week or ten days. A part of the affected individuals recover, but others continue weak and have a chronic form of the disease for months, during which time they continue to disseminate the contagion.

This disease is distinguished from diphtheria by the absence of the thick, tough, and very adherent newly formed membranes (false membranes) in the nostrils, mouth, and throat which are characteristic of

the latter. There may sometimes be a deposit of yellowish material on the walls of the mouth and throat, but it is easily broken up and removed.

Treatment.—The medical treatment of this disease may be very successful if properly applied. The sick birds should be removed from the flock and put in a warm, dry, and well-ventilated room which is free from drafts of air. The affected mucous membranes should then be treated by applying antiseptic and healing mixtures. The best method is to use a good spraying apparatus; but, lacking this, a small syringe, an oil can, or even a medicine dropper can be made to answer the purpose.

It has been recommended that the bird's head be plunged into a basin or bowl of the mixture and held there a few seconds, but not long enough to cause suffocation.

The remedies most suitable for such treatment are: Boric acid, 1 ounce; water, 1 quart. Or, permanganate of potash, 1 dram; water, 1 quart. Or, boric acid, 1¼ ounces; borate of soda, ½ ounce; water, 1 quart. Or, peroxid of hydrogen, 1 ounce; water, 3 ounces.

Where the inflammation has progressed to the eye, excellent results have followed the use of argyrol. One or two drops of a 15 per cent solution is introduced between the eyelids twice daily for a period of several days.

Before applying these remedies it is well to wash the eyes and mouth with warm water containing 1 teaspoonful of common salt to a quart, using a pledget of absorbent cotton and rubbing gently, while at the same time pressing and massaging about the nostrils and under the eyes to loosen the accumulated secretion. If there is much swelling under the eyes, it must be carefully opened with a sharp, clean knife, all the secretion removed, and the cavity washed with one of the above-mentioned solutions. A pledget of cotton moistened with the solution may be left in the opening for an hour or two, or it may be dusted with iodoform powder. When the swelling under the eye is not very large or hard, it may often be reduced by massaging it in such a manner as to press the contents toward the nostril. After treating the birds in this manner the head should be well anointed with pure vaseline or with camphorated vaseline.

The treatment of sick birds requires much time and patience, and there is always the risk that they may carry the contagion for several months after they are apparently well. Prevention is therefore much more profitable. To accomplish this, measures should be continually enforced which will exclude contagion of all kinds. New birds and those which have been to exhibitions should be isolated and kept under observation for two weeks before they are put with the flock, and all animals and wild birds excluded, so far as possible. The

houses should be kept clean and dry and occasionally disinfected. If the disease appears notwithstanding these precautions, isolate the affected fowls at once at a distance from the well ones, and apply disinfectants freely about the houses and runs. Also place sufficient permanganate of potash in all drinking water to give the latter a deep red color. If the disease proves of a severe type, it is often better to kill the entire flock, and after a thorough cleaning and disinfection of the premises to begin with new birds. This radical method avoids the retention of birds which may harbor the contagion and cause the development of subsequent outbreaks.

DIPHTHERIA.

Diphtheria is a disease having some of the symptoms of a cold, or of the contagious catarrh described above, but which differs from these and is especially characterized by the development of false membranes on the mucous surface of the nostrils, eyes, mouth, throat, and even of the smaller air tubes. The false membranes are new growths of a grayish or yellowish color, very tough, and very difficult to remove from the tissues beneath them.

Causation.—The diphtheria of fowls is caused by a filterable and invisible virus, and therefore is entirely distinct from the diphtheria of children, which is caused by a well-known bacillus. The disease is strictly contagious, and probably never develops as the result of exposure to cold and dampness, although these conditions favor its spread and tend to increase its malignancy. The contagion is generally introduced by newly purchased birds or by birds which have been to exhibitions and there exposed to sick fowls. Sometimes it is carried by pigeons and other small birds. Very often an outbreak is caused by contagion from an apparently well bird which had the disease and recovered months before.

The contagion is spread through the mucus which escapes from the nostrils, or that which is forced out in the acts of sneezing or coughing, in the saliva, the secretions of the eyes, and also the excrement. When the disease appears in a flock the floors of the houses, the drinking cups, and feeding troughs are at once infected by the diseased birds, and the well ones soon contract the disease from the contaminated water and food. It is consequently but a few days before a large part of the flock shows symptoms, though some are much more severely affected than others.

Symptoms.—Diphtheria begins as a local irritation or inflammation at some point on the internal surface of the mouth, throat, nostril, or eyes. At this time the general health is not yet affected, and there is nothing but the diphtheritic deposit to indicate that the bird has been attacked. This deposit is at first thin, yellowish or whitish in color,

and gradually becomes thicker, firmer, and more adherent, so that considerable force is required to remove it. The mucous membrane beneath the deposit is found, when the latter is removed, to be inflamed, ulcerated, and bleeding, but it is soon covered by a new deposit. This deposit is called a false membrane, and when it is situated where the air passes over it in breathing it dries, becomes uneven and fissured, and its color changes to a dark brown.

With pigeons the deposit is more friable and easily removed, and the mucous membrane beneath it is reddened but not ulcerated.

While the false membranes over the parts first affected are becoming thicker, the inflammation extends to the adjoining surfaces, and new diphtheritic centers develop, uniting with each other until the cheeks, the tongue, the palate, the throat, and the inside of the nostrils are covered. Very often the inflammation extends from the nostrils to the eyes and the sacs beneath the eyes, and sometimes it penetrates the air tubes to the lungs or the gullet to the crop.

This extension of the disease leads to the appearance of other symptoms. The inflammation in the nostrils causes sneezing and the escape of a thin, watery secretion from the nasal openings; the thick false membranes fill up the nasal passages and the throat and obstruct the breathing; a thick, viscid secretion collects on the eyelids and glues them together; the sacs under the eyes fill up, and swellings are caused which disfigure the head; the poison which is produced by the growth of the microbe beneath the false membranes is absorbed and affects the nervous system, causing dullness, depression, and sleepiness. The affected bird stands with the neck extended and the beak open to facilitate the entrance of air into the lungs, and from the corners of the mouth there hang strings of thick, tenacious, grayish mucus. At this time, which may be three to five days from the appearance of the first symptoms, the condition is very serious. Swallowing is difficult or impossible; the breathing is so obstructed that hardly sufficient air can be inhaled to support life; the head is swollen; the eyes are nearly or entirely closed; the feathers of the head, neck, and breast are foul with the decomposing secretions from the nostrils and mouth; there is considerable fever; an exhausting diarrhea sets in; there is rapid loss of weight; the comb and wattles become pale and cold; the temperature of the body finally sinks below the normal; and death soon follows.

When false membranes form in the gullet, crop, and intestines, there is a rapid aggravation of the symptoms, an intense diarrhea, and the escape of blood with the droppings. This type of the disease is more frequent with water fowl than other birds. Some fowls in a flock are resistant, and after a few days of illness make a rapid recovery. Others remain dull, weak, and thin in flesh, and may have more or less catarrh and difficulty of breathing for a long time.

The period between exposure to the contagion and the appearance of the first symptoms varies from 3 to 15 days; the duration of the disease varies from 2 to 3 days to as many weeks in the acute cases, while the chronic form may continue for several months. The average death rate is from 50 to 60 per cent of the flock.

Treatment.—The treatment of fowls affected with diphtheria requires much time and patience, and as a rule does not pay. It is better to kill those affected, bury or burn their carcasses, disinfect the poultry houses, and in that way eradicate the contagion as soon as possible, even if the whole flock must be sacrificed.

If it is decided to treat the sick birds, they should be removed from the flock and put in a comfortable, well-ventilated room which may be easily disinfected. Make a solution by dissolving 2 drams of common salt in a quart of warm water, and with a soft brush or a pledget of absorbent cotton dipped in this solution gently brush or rub the false membranes until they are disintegrated and loosened from the underlying tissues. Sometimes it is necessary to scrape them off with a spoon or knife, but it must be done carefully so that bleeding will not be caused or the sensitive tissues injured. After the false membrane has been removed, moisten a pledget of absorbent cotton in a 2 per cent solution of lysol or carbolic acid and apply it for a minute or two to the diseased surface. A solution which gives good results is made by dissolving 35 grains of chlorate of potash and 2 grains of salicylic acid in 1 ounce of water and adding 1 ounce of glycerin. This may be applied to the diphtheritic spots three or four times a day with a pledget of absorbent cotton.

Another solution which is often recommended is made by dissolving 16 grains of permanganate of potash in half a pint of water. A very good and also a harmless solution consists of 1½ ounces of boric acid and 1 ounce of powdered borax (biborate of soda) dissolved in 1 quart of water and applied warm. The two last-mentioned solutions may be used to wash the eyes or may be injected into the nostrils. Argyrol may also be used as recommended in contagious catarrh.

If large swellings appear beneath the eyes, they should be opened with a clean, sharp knife, the contents of the cavity removed, and the space frequently washed with the boric-acid-borax solution mentioned above.

Many persons think that the treatment is not complete without fumigation. To accomplish this vaporize tar water or oil of turpentine in the room by dropping it slowly on a hot brick or stone after the doors and windows have been tightly closed. If the operator remains in the room with the fowls, he can easily determine when as much of the remedy has been vaporized as can safely be used and

should stop at that point. The tar water is prepared by stirring two tablespoonfuls of wood tar in a quart of warm water and letting the mixture stand for a few hours.

The cages and the room in which the sick birds are kept should be disinfected daily with a 5 per cent solution of cresol or carbolic acid.

BIRD POX (CHICKEN POX).

Bird pox is a condition characterized by an eruption of nodules varying from the size of a millet seed to that of a pea, which occurs on the comb, wattles, ear lobes, and less frequently on the skin of other parts of the body. It is more frequent and more malignant in warm than in cold climates, but occurs in most parts of the world. Recent investigations make it probable that it is caused by a filterable virus which is identical with that of diphtheria. As the symptoms of the two conditions are generally quite distinct they are here described separately.

Causation.—Bird pox, so far as known, does not originate in any other way than by contagion. It seems to be produced by virus from fowls or pigeons affected with either the eruption of bird pox or the false membranes of diphtheria. Experiments have shown that both pox and diphtheria are easily inoculated from fowl to fowl and from pigeon to fowl, but the inoculation of pox from fowl to pigeon has proved very difficult and that of diphtheria impossible. The contagion is believed to exist in the blood as well as in the nodules which appear upon the skin.

The disease is generally introduced by new birds which are put into the flock or by exhibition birds which return infected. Probably it is often brought by pigeons, sparrows, and other birds which fly from one yard to another. The inoculation of the comb and wattles appears to occur by rubbing these parts with the infected feet or by being injured with the infected beaks of other birds.

The virus is quite resistant and requires thorough disinfection for its eradication.

Symptoms.—The eruption appears as round, oblong, or irregularly shaped nodules from the size of a pinhead to that of a pea or a hazelnut. They are seen especially about the beak and nostrils and on the comb, the eyelids, the wattles, and the ear lobes. In some individuals, and particularly in pigeons, the eruption is more generalized and is found on the skin of other parts of the body, as the neck, under the wings, on the rump, and about the cloaca. Here the nodules may become larger than on the head.

The nodules begin as small red or reddish-gray deposits with a shiny surface and gradually enlarge, while the color changes to a yellowish, brownish, or dark brown and the surface dries and be-

comes shriveled, uneven, and warty in appearance. Owing to the number of nodules and the extension of the inflammation, large patches of skin become thickened and covered with hard, dry crusts, closing the nasal openings or the eyelids and making it difficult even to open the beak.

In the milder cases the eruption is limited to the head, the nodules are distinct and small, and the general health of the affected bird does not suffer. The nodules soon dry, heal, and shrink; the crusts become loosened and fall off, and there is rapid recovery. In the more malignant cases the eruption is generalized over the surface of the body, the nodules are larger, and there is a diffuse inflammation and thickening of large areas of skin. If the crusts are rubbed or scratched off by the fowls, there occurs from the ulcerous surface a discharge at first watery, but later thick, yellowish, and viscid, which soils the feathers and, if abundant, gives off a disagreeable odor. This type of the disease is accompanied by fever, rapid loss of flesh, and prostration, and frequently causes the death of the victim. In the most malignant cases, especially with pigeons, the eruption extends to the mucous membranes of the eyes, nostrils, and mouth, causing a diphtheritic inflammation that is generally fatal.

Treatment.—The mild cases of this disease may be successfully treated by simple local applications. The crusts on the nodules are softened with carbolated ointment, glycerin, or oil, and after an hour or two removed by washing with warm water containing a little soap. The denuded tissue is then treated with a 2 per cent solution of creolin or lysol, or with a saturated solution of boric acid. Some prefer carbolated oil or carbolated ointment to watery solutions; others apply tincture of iodin. If there is much inflammation of the eyes, apply frequently with a medicine dropper or a pledget of absorbent cotton a solution made by dissolving 1½ ounces boric acid and 1 ounce biborate of soda in a quart of warm water. This solution may also be applied to the inflamed skin either before or after the crusts are removed.

As this disease is contagious, the houses, drinking vessels, and feed troughs should be kept disinfected during the outbreak and for some days after all the birds have apparently recovered.

BLACKHEAD (ENTERO-HEPATITIS).

This is a disease of the intestines and liver, which is most frequent with and most injurious to turkeys, but which also attacks common fowls. In the course of this disease the head often becomes dark colored or nearly black, and for that reason it is popularly known as "blackhead," although it is only the internal organs that are attacked by the parasitic microbe. The cause of the disease is a protozoal organism called *Amœba meleagridis*, the ameba of turkeys. The

contagion is widely disseminated and in some localities has made the production of turkeys nearly impossible.

Causation.—The ameba leaves the bodies of the sick birds with the excrement and infects other birds by entering the digestive organs with the food and drink. It passes along the alimentary canal until it arrives at the two blind pouches or lateral extensions called the ceca, where it begins its growth and produces the first signs of disease. Here it penetrates the lining membrane, increases rapidly in numbers, and sets up an inflammatory process which leads to a great thickening of the intestinal wall and to the filling up and obstruction of the tube with an accumulation of yellowish white or grayish cheesy material that is deposited in concentric layers.

The changes which are almost constantly found in the liver are explained by assuming that the microbes are carried by the blood from the diseased ceca to the liver, and are there deposited at different points, where they multiply and spread in all directions. In this way are formed the numerous centers of disease which appear on the surface of the liver as yellowish spots, but which when cut across are seen to be irregularly spherical in shape. The ameba are liberated in large numbers both in the ceca and in the liver, are mixed with the intestinal contents, and are distributed with the droppings.

There is some difference of opinion as to whether the ameba is ever present within the egg of diseased turkeys, but the indications are that the infection is not carried in this way. It no doubt often exists on the outside of the shell, from contamination when the egg passes through the cloaca, and for this reason the eggs should be carefully cleaned before they are put under the sitting hen or into an incubator.

An important recent conclusion is that common fowls harbor this parasite, although they rarely suffer sufficiently from its attacks to show marked symptoms of disease. They scatter the contagion constantly, however, and young turkeys, being more susceptible, contract a fatal form of the disease and are nearly all destroyed by it. For this reason it is very difficult to raise turkeys on or near grounds where there are common fowls.

Symptoms.—The symptoms of blackhead are most frequently seen in young turkeys, commonly called "poults," which are from 2 weeks to 3 or 4 months old. When young poults are infected experimentally by feeding them diseased livers they usually die in about two or three weeks, but when infected naturally they generally take in a smaller quantity of contagion and live a longer time.

The affected birds at first appear less lively than usual, are not so active in searching for food, and when fed show a diminished appetite. Diarrhea is a nearly constant symptom, being due to the inflammation of the ceca. As the disease progresses there is more dullness and weakness, the wings and tail droop, and there is often the pecu-

liar discoloration of the head which led to the disease being called "blackhead." There is increasing prostration and loss of weight; the affected birds, instead of following their companions, stand about in a listless manner, indisposed to move and paying little attention to what occurs about them.

The greater part of the affected poults die within three or four months after hatching; but with some the disease takes a more chronic form and does not cause death for a year or more. Nearly all die sooner or later from the effects of the disease, but in a small proportion of the cases there is healing and recovery.

The finding after death, in young turkeys, of the diseased and thickened ceca, plugged with cheesy contents, together with the yellowish or yellowish-green spots in the more or less enlarged liver are sufficient indications to warrant a diagnosis of blackhead.

Treatment.—The treatment of diseased birds has not given satisfactory results. The remedies most often used are sulphur 5 grains, sulphate of iron 1 grain; or benzonaphthol 1 grain, salicylate of bismuth 1 grain; or sulphate of iron 1 grain, salicylate of soda 1 grain. These remedies should be preceded and followed by a dose of Epsom salts (10 to 35 grains), or of castor oil (½ to 3 teaspoonfuls). Fifteen grains of catechu to the gallon of drinking water may also have a beneficial effect. It seems clear, however, that it does not pay to doctor the sick poults and that the only hope of success at present is in preventing their infection.

The measures of prevention which have been suggested are (1) obtaining eggs from birds believed to be healthy; (2) wiping the eggs with a cloth wet with alcohol (80 to 90 per cent) before they are placed in the incubator or under the hen for hatching, to remove any contagion that might be on the shell; (3) hatching in an incubator, or at least removing the eggs from under the hen a day or two before hatching would occur, wiping with alcohol, and finishing in an incubator, in order to avoid exposing the poults to the hen; (4) placing the young poults on ground at a distance from all other domesticated fowls and which has not recently been occupied by other fowls; (5) excluding so far as possible pigeons, other wild birds, and rats and mice from the houses and runs occupied by the turkeys; (6) the frequent disinfection of the houses, feed troughs, drinking fountains, etc.; (7) the immediate killing of diseased birds and the destruction of their bodies by fire.

These radical measures are necessary, and in sections of the country which are not too intensely infected they will make it possible to carry on the turkey industry successfully. However, it must be admitted that up to the present blackhead has proved to be the most difficult of all diseases to prevent or eradicate.

The destruction of the contagion, after it has been introduced into a poultry yard, has also been found difficult or impossible. Some have proposed to dig up and burn the surface soil to depth of several inches, which might be done with small yards but is impossible with large ones. In most cases the poultryman must be contented with the application of a layer of freshly burned lime that has been carefully slaked to a fine, dry powder. After a few weeks this ground should be plowed and another layer of lime applied. The manure which has accumulated should be burned or mixed with lime and plowed into the ground of some distant fields. The walls and floors of the buildings should be covered with a good limewash containing 6 ounces of carbolic acid to the gallon. The fences should receive a coat of limewash. The feeding troughs and drinking vessels should be put into a kettle of boiling water for half an hour. Troughs too large for this should be burned and replaced by new ones. After these measures are adopted, the longer the premises are left vacant the more likely is the contagion to be completely destroyed. The freezing and thawing of a winter and spring will be found of great assistance. In beginning with a new flock the precautions already mentioned must be adopted to prevent the reinfection of the premises.

TUBERCULOSIS.

The tuberculosis of fowls is a chronic contagious disease, characterized by the development of nodules called tubercles in various organs of the body, but most frequently in the liver, spleen, and intestines. The disease is caused by a bacillus which differs somewhat in its manner of growth in artificial cultures from the bacilli which cause the tuberculosis of people and of cattle. The tuberculosis of fowls is readily communicated to most species of birds and to several species of mammals, but it is almost impossible to communicate the tuberculosis of man and of cattle to fowls. Parrots and the smaller cage birds are very susceptible to human tuberculosis, however, and are often affected by it.

Causation.—Tuberculosis is generally brought into the poultry yard with fowls that are purchased from infected flocks or with the eggs of diseased birds that are obtained for the purpose of hatching. If the disease exists in neighboring flocks the contagion may be carried by small birds or animals passing from one yard to another. A peculiarity of the tuberculosis of birds is that the liver and intestines are nearly always very severely affected, and that as a consequence the bacilli are very numerous in the intestinal contents and are scattered with the droppings everywhere that the fowls go. The introduction of a single diseased bird may, therefore, cause the infection of the greater part of the flock in a few weeks. In the same way, when

wild birds contract the disease the bacilli are carried and deposited in all the yards which they visit.

The eggs of diseased birds frequently contain the bacilli, as has been proven by the inoculation of and transference of the disease to rabbits and guinea pigs. The young chicks hatched from such infected eggs are diseased when they leave the shell and, of course, soon infect the poultry with which they run. Moreover, since the sterile incubated eggs are often fed to chickens, it is clear that even the eggs which do not hatch may introduce the contagion unless they are cooked before feeding.

Pigs, cats, rats, and mice are especially liable to be infected with fowl tuberculosis from eating the carcasses of birds which have died, and these animals serve to keep up the contagion and may communicate it to other fowls. Even calves and colts are sometimes found suffering from this form of tuberculosis.

Symptoms.—These are generally not observed in the internal tuberculosis of fowls until the disease has reached an advanced stage of development. They begin with gradual loss of weight, wasting of the muscles, paleness of the comb, and toward the end dullness, sleepiness, and diarrhea. Very often there is at the same time a tubercular inflammation of the joints and of the sheaths of tendons, which is revealed by lameness, swelling of the joints and legs, and sometimes by the formation of hard, external tumors of considerable size. Occasionally the skin over the swollen joints breaks, the interior of the joint is ulcerated, and a small quantity of pus containing large numbers of tubercle bacilli is discharged. Swellings and bony enlargements of the joints with fowls are invariably suspicious, and their nature should always be investigated by killing the bird and examining the liver and spleen to determine if these have any whitish or yellowish spots on their surface which when cut into prove to be tubercular masses.

Treatment.—There is no treatment that will cure fowls which have been attacked with tuberculosis. When the disease is discovered the effort should be to eradicate it at once by killing off the whole flock and thoroughly disinfecting all the houses and runs.

As the great majority of the birds will probably be more or less affected, the chances are that any which are saved will have diseased livers and intestines, from which the bacilli will escape and keep up the infection of the flock and the runs. The danger of this is so great that no attempt should be made to keep any of the fowls that have been exposed to the contagion, no matter how valuable they may be. The bodies of the birds which have died or are killed, as well as all the accumulated manure, sweepings, and scrapings of the poultry houses, should be completely destroyed by fire.

So far as known there is no danger of communicating the disease to man by eating the cooked flesh of tuberculous fowls. In most cases, however, the diseased birds are so emaciated and their general health so affected by fever and diarrhea that their flesh is not fit for human consumption. It is better in all cases to burn the carcasses of the birds in which tubercular nodules are found, and thus avoid all danger of the disease being communicated to either man or animals.

ASPERGILLOSIS.

One of the common molds, called *Aspergillus fumigatus*, sometimes attacks the respiratory or digestive organs of fowls, producing either whitish or yellowish tubercle-like nodules in the tissues or large, flat elevations of a dirty yellow or greenish coloration on the surface of the mucous membranes. Each of the nodules contains a growth of the mold at its center, which is inclosed and imprisoned by a wall of animal cells. The flat elevations, however, represent the free growth of the mold on the surface of the mucous membrane, having very much the appearance which it presents when growing outside of the body on dead organic matter. The greenish color of the diseased area is due to the greenish filaments of the mold or fungus growing upon its surface. The filaments are not all on the surface, however, but they penetrate deeply into the tissues, causing inflammation and swelling, which obstructs the respiration, and at the same time they apparently produce a poison, which causes the general depression and fever. The changes caused by the development of this fungus are most frequently seen in the mouth, the trachea, the bronchial tubes, the lungs, and the air sacs, but they may also occur in the alimentary canal.

Causation.—The *Aspergillus fumigatus* is a very common fungus of great vegetative and resisting powers which is found everywhere growing upon dead organic matter of the most varied kinds. Its development is favored by warmth and moisture, and its spores are often found in enormous numbers in musty or moldy hay, straw, or grain. The mucus on the surface of the membranes, the serum beneath them, and the temperature of the bird's body are all favorable to its growth, while in addition it has the power to resist the efforts of the animal tissues to overcome and dislodge it. Having such characteristics, this fungus is one to be excluded so far as possible from the habitations of poultry, for otherwise it may cause severe and fatal disease.

The spores of aspergillus are most frequently introduced with moldy hay, straw, or chaff that are given to the fowls to scratch in. Often the fungus grows on accumulations of manure, old leather, and similar substances when they are sufficiently moist, and produces spores in enormous numbers. Not all birds are susceptible to

its attacks, and it seems to be the delicate breeds and the weak individuals which are most frequently its victims.

Symptoms.—This disease may be limited to a single bird or it may affect a large number. When the air tubes or lungs are attacked the first symptoms are a slight catarrh with accelerated breathing. Soon the swellings obstruct the passage of air and there is a rattling or croupy sound, heard chiefly during expiration. The affected birds mope, separate themselves from the remainder of the flock, remain in a sitting posture; if made to move, it is seen that they are weak and scarcely able to walk, and if they try to run they soon fall from exhaustion. The difficulty of breathing increases rapidly; they gasp for breath and make movements of the head and neck as if choking; there is fever, diarrhea, drooping wings, great depression, a tendency to sleep, and finally suffocation and death.

When the disease is limited to the large air sacs the only symptoms are progressive loss of flesh and weakness. If the small air sacs of the bones are involved, which rarely occurs, there may be lameness, with swollen and inflamed joints. After death the yellowish nodules are sometimes found in the liver and kidneys as well as in the other organs which have been mentioned.

Treatment.—This disease is a most difficult one to cure, but sometimes affected birds may be saved by applying flowers of sulphur or tincture of iodin to the diseased patches seen in the mouth and throat, and causing the birds to inhale the vapor of tar water or turpentine. Tar water is obtained by stirring 2 tablespoonfuls of wood tar in a quart of warm water and letting the mixture stand for a few hours. Then the birds are taken into a closed room, where the tar water is poured, a small quantity at a time, on a hot brick or stone until the atmosphere of the room is well charged with the vapor.

The disease is prevented by giving only clean and bright straw or chaff for the fowls to scratch in, by keeping the houses and yards clean, and using grain and meal for feed which are sound and entirely free from mold. The birds which are sick should be removed from the flock and the bodies of those which die should be burned or buried. The fungus sometimes spreads from bird to bird; consequently the isolation of the sick and the disinfection of the houses should not be neglected.

COCCIDIOSIS.

Coccidiosis is a disease produced by the small forms of animal life called "coccidia." These germs are widely distributed in nature and frequently attack birds and the smaller mammals, such as rabbits, rats, and mice. They are very destructive to young birds, as will be explained in describing the infectious diseases of young

chicks, but in this place the description will be limited to the effects of this parasite on adult fowls.

Causation.—Many different species of birds are attacked by coccidiosis, and it is probable that the disease in fowls is always the result of contagion. Pigeons are particularly liable to the disease, and are frequently responsible for the outbreaks in the poultry yards. The transmission of the contagion from diseased to healthy birds occurs by contamination of the food, water, gravel, and other substances taken into the digestive organs. The coccidia multiply with great rapidity in the intestines of diseased birds, and enormous numbers are discharged with the droppings and are carried on the birds' feet to the feed troughs and drinking fountains unless these are well protected and of such form that they can not be reached by the feet. Under any circumstances they are spread over the floor of the houses and the surface of the runs, and many will be picked up with gravel, grain, and other substances. The germs are found in the part of the small intestine nearest to the gizzard, where they cause inflammation, with redness and thickening of the intestinal wall. They are also found in the ceca, which are frequently thickened and distended with a whitish, yellowish, or greenish yellow, pasty mass. After two or three weeks the disease may extend to the liver and lungs, where it is recognized by whitish or yellowish spots or by large cheesy nodules. Geese are attacked by another species, which causes nodules in the kidneys.

Symptoms.—Adult fowls have considerable powers of resistance to this parasite, and the disease with them is more frequently seen in a chronic form. The symptoms are dullness, weakness, sleepiness, diarrhea, and loss of weight, although the birds retain their appetites for a considerable time. In many cases the only symptoms are diarrhea, with loss of weight, and after a time apparent recovery, though the germs continue to multiply in the intestine and to be spread with the droppings for several months afterwards. Fowls affected in this manner may die suddenly without previously showing any serious symptoms.

Pigeons are affected with a more acute type of this disease in which the symptoms appear only a short time before death. Generally, however, they are dull and sleepy for a day or two, and sometimes they have a chronic form, characterized by diarrhea and loss of weight.

Geese with coccidiosis of the kidneys lose flesh rapidly, without apparent cause, and become very weak and almost unable to walk. They remain quiet most of the time, with belly resting upon the ground. Some of them are conspicuous by lying on their backs with their feet widely separated, and if placed upon their feet they take

a few steps, fall, and resume the former position. In all such cases the birds lose their appetites and continue to get weaker until they die.

Treatment.—The most successful treatment has been to put 3 grains of copperas (sulphate of iron) to a quart or 15 grains of catechu to a gallon of the water given the birds to drink. They should also be given an occasional dose of calomel ($\frac{3}{4}$ to 1 grain) or of castor oil (2 to 3 teaspoonfuls). They may also be given castor oil containing 5 to 10 drops of oil of turpentine with each dose.

As the coccidia are brought on the premises with birds or eggs for hatching obtained from infected flocks or by pigeons flying from place to place, the necessary precautions should be observed to guard against such channels of infection. Fowls and eggs should be obtained only from flocks known to be healthy, and pigeons should be excluded from the poultry yard.

This form of contagion is very difficult to destroy, and the most active disinfectants should be used. A mixture containing 10 per cent of the compound solution of cresol is none too strong.

The bodies of the birds which die should be burned.

WHITE COMB (FAVUS).

White comb, baldness, or favus of fowls is a contagious disease that begins by the formation of white or grayish spots on the comb, ear lobes, or wattles. These spots are caused by the growth of a fungus called *Lophophyton gallinæ*, and they continue to enlarge, run together, and become more inflamed until all the skin of the head and neck is much thickened, roughened, covered with crusts, and more or less bare of feathers. In extreme cases this inflammation may extend over the skin of other parts of the body, affecting the general health and causing weakness, with, finally, exhaustion and death.

Causation.—This disease is transmitted from fowl to fowl by simple contact and is easily transmitted by inoculation from fowl to fowl. It is most frequently seen affecting common fowls and turkeys, and may be communicated by inoculation to mice and rabbits, but attempts to infect lambs, dogs, rats, guinea pigs, and pigeons have failed. It is also easily inoculated on man, producing large red, scaly patches on the skin, and such patches sometimes develop spontaneously, being no doubt due to contagion from affected fowls.

The filaments of this fungus do not penetrate deeply into the skin, but remain very near to the surface, and consequently the general health does not suffer in the early stages of the disease. It is only when a large area of skin is affected that there are symptoms, such as diminution of appetite, loss of weight, and great weakness, which indicate the absorption of poisonous products. Young birds are believed to be more susceptible than older ones, and some breeds

appear to inherit a predisposition to this disease, but no age or breed is entirely exempt from it.

Symptoms.—Favus generally begins on the bare parts of the head as small white or grayish spots, round or irregular in form, which increase in number and size and join together until the whole surface is covered. The affected spots are covered with dry, scaly, dirty-white crusts with an irregular surface, and have an appearance of being formed of concentric deposits. Removing the deposit the skin beneath is seen to be slightly inflamed and abraded. Often the circular spots enlarge regularly and are covered by layers of scales thicker at the periphery than at the center, which gives them a peculiar cup-shaped appearance. As the disease advances the skin becomes thicker, until in the course of a month it may reach one-third of an inch and considerably change the appearance of the head. The neck and body are gradually invaded, the feathers become brittle and break off, leaving a deep depression in the center of a cup-shaped disk. Occasionally the disease is inoculated into the feathered parts of the skin and begins there instead of on the bare parts of the head, but this is exceptional.

The disease when limited to the comb and wattles may disappear without treatment, but after it has invaded the feathered parts it almost invariably continues to advance, and the birds grow weaker until they die from this or some other disease to which their debilitated condition has made them abnormally susceptible.

Treatment.—When only the bare parts of the head are affected the disease may be cured by applying tincture of iodin to the diseased spots. Some recommend an ointment of calomel 1 part, vaseline 8 parts; others prefer a mixture of soft soap 20 parts, carbolic acid 1 part, to be well mixed and applied daily. An ointment of red oxid of mercury 1 part, vaseline 8 parts, is also used, as well as olive oil containing 1 per cent of carbolic or cresylic acid.

It is essential that the affected bird should be separated from the flock, put in a dry, clean place, and given good nourishing food. If the feathered parts of the body are affected, it is better to kill the bird, as the treatment would be long and expensive and there would be danger of the disease spreading.

The disease should be prevented by excluding all affected birds, by burning the bodies of those which die or are killed, and by disinfecting the houses where diseased birds have been.

"GOING LIGHT" (LOSS OF WEIGHT).

"Going light" is a term applied to fowls which persistently lose weight, become emaciated, anemic, weak, and unproductive. Sometimes it is only one or two birds that are so affected, but frequently it is a large part of the flock. Fowls "go light" from different causes;

sometimes it is the result of being severely infested with lice and mites; at other times it is due to intestinal worms; and at still other times to chronic forms of infection with aspergillosis, coccidiosis, tuberculosis, or cholera. When, therefore, the fowls are not thriving, and when lifted appear to weigh little more than should the feathers with which they are covered, an investigation should be made to determine the cause. This should begin with the food supply and it should be ascertained whether the birds have been receiving a sufficient quantity of sound and nutritious food. Then the birds and the houses should be carefully examined for lice and mites. Separate the feathers under the wings, about the vent, and over the rump, and look carefully for these parasites. Then examine the houses, take out the roosts and examine these carefully, especially on the undersides and at the ends; also the woodwork on which the roosts were supported. If no defect is found in the rations, and the birds and houses are free from lice and mites, kill one of the lightest birds and carefully open the intestines for their entire length to learn if the birds are harboring a sufficient number of intestinal worms to account for their condition. A few worms would not have such a pernicious effect; but if there are many they would certainly be partly, and probably would be entirely, responsible for the emaciation. If the fowl is found to have few, if any, parasitic worms, the cause of the trouble is probably a chronic infection with one of the microbes mentioned above.

The treatment of this condition will obviously depend upon its cause. If it is found to be due to insufficient food or food of bad quality, a proper ration must be provided. If it is due to lice and mites or to intestinal worms, these parasites must be combated by the measures elsewhere enumerated. If it results from chronic microbian infection, an effort should be made to overcome this by thorough cleaning and disinfection of the houses, by feeding sour milk or buttermilk with the ration, and by giving an occasional purgative, such as Epsom salts or castor oil. In any event the food must be abundant, the fowls must have plenty of exercise, and the houses must be kept in a dry and sanitary condition.

INFECTIOUS DISEASES OF YOUNG CHICKS.

Young chicks are particularly susceptible to the attacks of the various microbes which cause disease in adult fowls, and the conditions of infection, the symptoms, and the preventive measures to be adopted vary to such an extent that they must be given special consideration.

WHITE DIARRHEA.

This is a condition which has as its most prominent symptom more or less profuse diarrhea, the droppings consisting almost entirely of

mucus from the intestinal tube and the white secretion of the kidneys. The diarrhea results from irritation of the intestines and the increased secretion of mucus, while the large quantity of white material secreted by the kidneys is due to fever and rapid breaking down of the elements of the tissues. This condition is most frequently seen with incubator chicks, but is also common with those which are hatched under hens.

Causation.—It has been found by investigation that the white diarrhea of young chicks is caused by at least four different kinds of infection, and each of these needs to be studied separately. All of these microbes also infect adult fowls and are generally communicated directly or indirectly from these to the chicks.

The most common cause of the disease is a bacillus called *Bacterium pullorum*. This often infects hens and also the eggs which they lay. Such eggs produce chicks which have the germs of the disease within them when they are hatched, and these chicks show symptoms within the first few days of their lives. The contagion may also be communicated from chick to chick by means of the microbes scattered with the droppings, which contaminate the food and drink, and cause the appearance of the symptoms when the birds are from 1 to 2 weeks old. The chicks are most susceptible to infection during the first 24 hours of their lives, are more resistant during the second and third days, and are practically insusceptible after the fourth day. Those that sicken later must have taken the microbes into their bodies before they reached that age. Incubators and brooders, as well as coops, become infected and preserve the contagion indefinitely. Adult fowls are resistant to this microbe and do not show any symptoms even when they are laying infected eggs.

The cholera bacillus may also be carried by laying hens and infect the egg before it is laid. The young chicks hatched from such eggs soon show symptoms of disease and communicate the contagion to others at all ages.

The coccidia which cause a chronic disease in adult fowls may also infect the eggs and cause disease with similar symptoms in the chicks.

The aspergillus fungus is the fourth cause of white diarrhea. It occasionally is included in the egg when it is laid, but it may also penetrate the shell when eggs are packed in moldy chaff, straw, or grain, or allowed to get damp.

All of these microbes may also be carried on the outside of the shell, and may infect nest boxes, incubators, brooders, and yards where diseased chickens have been.

Symptoms.—The symptoms of white diarrhea are seen in young chicks which are from a day or two to 3 or 4 weeks old. In the most acute form they may die suddenly after having shown but slight symptoms for a short time. Generally, however, there is first ob-

served a disposition to huddle together and to remain under the hover or under the hen more than young chicks should. Very soon they appear listless, indifferent to what is going on about them, stupid, and sleepy. They stand in one position or sit still with the eyes closed, and the few efforts which they make to pick up food appear mechanical and unsuccessful. Their plumage loses its luster, the wings droop or project slightly from the body, and the characteristic diarrhea soon appears. The droppings which are voided may be white and creamy, mucilaginous and glairy, or they may be mixed with a brownish material. Often the sticky excrement adheres to the downy feathers about the vent, dries, and continues to accumulate until it completely covers and plugs this opening. This condition, known as "pasting up behind," will, unless soon relieved, bring about the early death of the chick.

Many of the diseased chicks chirp or peep almost constantly, and when attempting to void the excrement they may give utterance to a shrill cry, as if the effort brought on paroxysms of pain. As death approaches the breathing becomes labored, and the abdomen heaves with each breath. Often the disease is of a more chronic type and has a longer course. The young birds with diarrhea gradually waste away, become weaker and more emaciated until their legs are scarcely able to support their bodies. They try to brace themselves by standing with the legs apart or they rest against a wall or other object for support. Many of them have the peculiar form of body called "short backed," which results from the distention of the abdomen and its projection backward, which makes the back appear too short for the body. Toward the last the strength is completely exhausted, and the chick sits constantly or lies on the side with outstretched wings until it dies.

The most prominent and characteristic symptoms in nearly all cases are the white diarrheal discharges and the rapid wasting away of the affected birds. The losses vary from 50 to 80 per cent of the chicks hatched. Sometimes it is impossible to raise any of them.

Treatment.—The medical treatment of affected chicks is impracticable, as it is too expensive and has very little effect on the course of the disease. The birds may be given sour milk or buttermilk to drink, or, lacking this, 15 grains of powdered catechu may be added to the gallon of drinking water.

The preventive measures should begin with the eggs used for hatching. If these are purchased they should only be accepted from flocks known to be healthy, and the eggs of which give rise to healthy chicks. If this assurance can not be obtained, it is better to produce the eggs needed for hatching on the home farm and from hens that are known to be free from infection.

Having obtained the eggs, they should be kept until ready for incubation in a dry, moderately cool place, so spread out that the air can circulate over them and carry away the moisture which they exhale. They should not be placed in hay, straw, chaff, or other substance liable to become musty or moldy. Before putting them into the incubator or under the hen they should be wiped with a cloth wet in grain alcohol of 70 to 80 per cent strength to remove any germs that might be on the surface of the shell. The hens used for hatching should be free from all infection and the incubator should be thoroughly cleaned. If there have been any sick chicks in it, it should be disinfected by washing with compound solution of cresol (5 per cent solution). The same precautions should be adopted in regard to the brooder.

If the hatching is done by a hen the brood should be put upon fresh ground, and any chicks which sicken should be immediately removed and isolated or killed. By removing frequently to fresh ground or by frequent disinfection the disease may sometimes be limited to a few individuals.

If the hatching is done in an incubator and there is reason to suspect that the disease may develop, it is well to divide the trays and the brooders by light partitions so that not more than 4 or 6 chicks will be in one lot and exposed to each other. If white diarrhea appears in any of these lots, such lots may be removed and the places which they have occupied may be disinfected. After four or five days the partitions may be removed and the healthy lots of chicks put together. In this way the greater part of the chicks are protected against the most common form of the disease.

BROODER PNEUMONIA.

This is an inflammation of the lungs caused by the growth of the aspergillus fungus in the smaller air tubes and in the lung tissue. It is believed that it may occur from infection carried within the egg. Whether this infection is derived from the hen or from the material in which the eggs have been packed is not definitely known, but the latter method of infection is the more probable. The fact of the lungs being the principal seat of the infection indicates that the spores in most cases are inhaled with the breath and germinate at or near the points where they are deposited. The inference from this method of infection would be that the incubators or brooders, or both, had been allowed to get filthy and moldy, and that the atmosphere in these was filled with aspergillus spores.

The symptoms are very similar to those described as present in white diarrhea, but the breathing is more rapid and difficult and is sometimes accompanied by sounds due to obstruction of the air tubes. The disease is not generally distinguished from white diarrhea, as

this symptom (white diarrheal discharges) is usually present in the lung disease as well as in the intestinal infection.

The sick chickens can not be cured, and therefore all the efforts must be directed toward prevention. The measures mentioned for the prevention of white diarrhea are applicable to brooder pneumonia, but if the disease has once occurred among the chicks especial care must be given to the cleaning, disinfection, and drying of the incubators and brooders before they are again used. It is probable that this disease is generally due to failure to maintain a proper degree of cleanliness.

GAPES.

Gapes is a disease of chickens which develops during the first few weeks of their lives and is made evident by frequent gaping. It is caused by a parasitic worm (*Syngamus trachealis*) which attaches itself to the internal surface of the windpipe, sucks blood from the mucous membrane, and obstructs the passage to such an extent as to interfere seriously with the breathing. The insufficient supply of air, the loss of blood, and the diminished activity in looking for food lead to a weak and bloodless condition and often to death from overcrowding or exposure that a well chick would be able to resist without injury. Sometimes so many worms accumulate in the windpipe that breathing becomes impossible and the chick dies from suffocation.

Causation.—The worm which causes this disease is sometimes called the red worm or the forked worm because of its color and of the fact that the male and female are so firmly grown together that they can not be separated without tearing the tissues. The two worms united in this manner appear at first sight like a single worm with two necks and two heads. The female is a little more than one-half inch in length and the male one-fifth inch. The heads of both are attached to the mucous membrane, irritating it to such a degree that there is an increased secretion of mucus, which collects and increases the difficulty of breathing.

A large number of eggs develop in the female worm while in the windpipe, and these are either thrown out by the chick while sneezing or they are swallowed, pass through the stomach and intestines unharmed, and are scattered with the droppings. These eggs adhere to the food or get into the drinking water and thus infect other chicks and keep up the disease indefinitely. Often the red worms are coughed up, but they are immediately seized and swallowed by some of the chicks, and in this manner also the disease is spread.

The eggs of this worm live a long time in the soil and are sometimes taken into the digestive tube of earth worms. In badly infested ground a considerable proportion of the earthworms may, if eaten, be capable of causing the disease in chicks.

These facts explain why ground upon which chickens are raised year after year becomes so badly infested, and how the infection is carried over from one year to the next. It seems that the worms may also be carried by grown fowls and by some wild birds and that this is another means for their preservation.

When the eggs of this worm are taken into the stomach of the chicks the young worms are soon liberated and find their way in a few days to the windpipe, where they may be seen already attached within a week.

Symptoms.—The symptoms of gapes are most frequently observed in chicks from 10 days to 4 weeks old. The affected birds cough or sneeze with an abrupt, whistling sound and a more or less labored effort. Very soon they begin to gape, extending the neck and opening the beak, thus indicating that they are not getting a sufficient supply of air. During the first few days the appetite is ravenous, but in spite of the quantity of food eaten the birds become weak, anemic, and emaciated. Later there is little appetite, the affected birds are dull, have difficulty in keeping with their companions, and as the disease advances their wings droop and they stand with closed eyes and head drawn back into the body. Frequently the head is thrown forward and they gape or give it a convulsive shake in order to loosen the obstruction in the windpipe and permit the entrance of air. In this condition they are liable to die suddenly from suffocation, from exhaustion, or from being trampled by their fellows at night.

The most vigorous and the older birds show only mild symptoms or none at all. They may gape occasionally, but their appetites remain good and they continue to grow. However, as the soil becomes more and more intensely infested the proportion of the chickens which are able to resist the attacks of these parasites becomes less, until finally it may be almost impossible to raise either chickens or turkeys.

Treatment.—Reliance must be placed upon prevention rather than cure, because a chicken 2 to 3 weeks old has not sufficient value to warrant the expenditure of much time or medicine in its treatment.

Sometimes it is found advisable to extract the worms or to inject some liquid into the windpipe which will kill them. Extractors are made in various ways. Generally a small quill feather is stripped of all of its web except a small tuft at the end, and this is used either dry or moistened with kerosene or oil of turpentine. A fairly good extractor may be made by taking a hair from a horse's tail, bending it in the middle, and twisting the two ends together so as to form a loop; or a similar loop may be made by cutting the hair, laying the two pieces side by side, tying a knot near the end, trimming the short ends close to the knot, and twisting the long ends together. These homemade extractors have been imitated in the

poultry-supply trade by doubling and twisting a small flexible wire which carries a few moderately stiff hairs to scrape off the worms.

These extractors are all used in the same manner. The chicken's beak is forced open with the thumb and fingers of the left hand, while the extractor is held in the right hand. When the glottis, which is a small aperture at the root of the tongue, is opened for breathing, the extractor is carefully inserted and pressed downward into the windpipe. The neck should be kept extended in a straight line, so that the extractor will enter freely and not injure the delicate walls of the windpipe. At the first insertion the loop or brush should not pass more than an inch below the glottis; then it should be given two or three turns between the thumb and finger and withdrawn. If any worms adhere to it, these should be dropped into a basin of hot water or kept and burned. The extractor may now be inserted a little deeper, and so on until it reaches nearly the full length of the neck. If the slightest resistance is felt to the entrance of the extractor, it should not be pressed upon or inserted any farther. In all cases the extractor must be quickly withdrawn to avoid suffocating or otherwise injuring the chicken. Often 8 or 10 worms may be removed in this manner, and if the treatment has not been so rough as to cause injury the symptoms will be very much improved.

Recently good results have been reported from medicating drinking water with 15 grains of salicylic acid or 3 drams of salicylate of soda to the quart of water, and in Germany the disease is said to be successfully treated by introducing a small soft-rubber tube into the windpipe, in the same manner as described for an extractor, and injecting 3 to 10 drops of a 5 per cent solution of salicylate of soda.

The best method of prevention is to put the chicks, when hatched, on fresh ground; to remove, place in a separate coop, and treat any that show symptoms, and to plow and seed down the old, infected runs, not permitting chickens to go upon them for two or three years.

WORMS.

Sometimes the fowls of a flock become badly infested with worms, which live in the crop, stomach, and intestines and either cause serious disease or affect the nutrition, so that the birds become weak, bloodless, and unproductive. The nature of the condition is determined by examining the birds that die, or by killing one that is very thin and weak. The intestines, the stomach, and the crop should be opened and their contents carefully examined. If a considerable number of roundworms or tapeworms are found, the remainder of the flock should receive appropriate treatment.

Treatment.—The remedies which are used to dislodge these parasites should be given when the birds are fasting. They should have

a light feed at night and should be given the medicine the following morning. Two or three hours after giving the medicine they should have a purgative, which may be Epsom salts, 40 grains for each adult bird thoroughly mixed with a small quantity of moist mash and so distributed that each bird will get its share, or they may be given 2 to 3 teaspoonfuls of castor oil. An hour later a light ration may be given.

One of the best remedies is oil of turpentine, which may be mixed with an equal quantity of olive oil and 20 to 30 drops of the mixture given at a dose. This is followed in two hours with 2 to 3 teaspoonfuls of castor oil.

Thymol is especially active in the case of roundworms, and 1 grain of it may be made into a pill with a little bread and butter and given to each fowl. It should be followed by a purge, as in the case of other remedies. Santonica or worm seed in doses of 7 or 8 grains is also successfully used to combat this class of worms.

The remedies which are particularly efficacious for tapeworms are powdered areca nut, 30 to 45 grains; powdered male fern, 30 to 60 grains; kemala, 30 to 40 grains for each fowl. These are followed by Epsom salts, castor oil, or calomel (one-third grain). Areca nut, male fern, and kamala may produce bad effects in turkeys and geese, and must be given to these birds in comparatively small doses.

Preventive treatment must be carried out at the same time as the medical treatment or the birds will be immediately reinfested by eggs or embryos of worms taken with the food or drink. Ponds or puddles of stagnant water should be drained or filled with earth; houses and runs (if small) should be cleaned and disinfected with 5 per cent cresol solution; feeding troughs and drinking vessels should be cleaned daily and disinfected with the same cresol solution or with boiling water; the manure should be collected daily, mixed with an equal quantity of freshly slaked lime, and put where the fowls will not have access to it.

It is considered preferable by some poultrymen, in the case of a badly infested flock, to kill off all the birds and begin a new flock on fresh ground with chickens hatched in incubators or with fowls from a flock known to be healthy.

MANGE (SCABIES).

Fowls and pigeons are affected by scabies, but the disease is not communicated from pigeons to fowls, nor vice versa, as the parasitic mites are not identical.

Causation.—The mites which cause the disease are introduced into the poultry yard by affected fowls, and they spread rapidly from fowl to fowl until nearly or quite all of the birds are affected. The

mite lives at the base of the feathers, where it bites the skin and causes intense itching.

Symptoms.—This form of mange is often called depluming scabies on account of the rapid destruction of the feathers. It generally begins in the spring, is most active during the warm weather, and disappears in winter. The most prominent symptom is a loss of feathers from spots of various sizes on different parts of the body. It usually begins on the rump and spreads rapidly to the back, thighs, breast, neck, and head. As the mites progress from the starting point over the surface of the body their advance is indicated by the falling of the feathers, until finally the fowl becomes nearly naked, the large feathers of the tail and wings being all that remain.

The skin which is bared in this manner is smooth, soft, and little if any changed by the disease. However, if the stumps of the feathers are examined soon after the breaking of the quill they are found surrounded by scales and crusts, and by pulling out the adjoining feathers they are seen to be similarly affected.

The irritation produced by this mite leads the fowls to pull out their feathers, and they often acquire the habit of feather pulling, attacking the plumage of other birds as well as their own. Depluming scabies is often mistaken for the vice of feather pulling or for irregular molting. Usually the general health of the affected birds does not suffer greatly, but if the disease is allowed to continue untreated some of the hens lose flesh and become unproductive, while the males may show great weakness and anemia.

Treatment.—Apply to the affected spots of the skin and for some distance around them an ointment made by thoroughly mixing 1 part of flowers of sulphur with 4 parts of vaseline or lard, or 1 part of carbolic acid with 50 parts of vaseline. A convenient liquid preparation is made by mixing Peruvian balsam 1 ounce, alcohol 3 ounces. One of these preparations should be selected and applied at least twice with an interval of about a week. A good lice powder should be applied to all of the fowls a day or two before beginning the other treatment, and at the same time that the latter is applied the houses should be thoroughly cleaned and disinfected.

SCALY LEG, MANGE OF THE LEG.

This condition is caused by a mite of another species from that which causes mange of the body. It affects fowls, turkeys, pheasants, and cage birds. While usually it does not affect the general health of the birds, it gives them a very unsightly appearance and is an indication of neglect and bad management on the part of the owner. The disease occurs only by contagion from other birds; it spreads very slowly, and many individuals escape it entirely, although constantly exposed to it.

Symptoms.—The disease is easily recognized by the enlargement of the feet and legs and the rough appearance of the surface caused by the loosening and raising of the scales on the legs and the upper surface of the feet. This parasite begins its attack in the clefts between the toes and gradually spreads forward and upward until the whole of the foot and shank becomes affected. The two legs are usually attacked at the same time and about to the same degree. At first there is seen only a slight roughening of the surface, but the continued irritation by the mite causes the formation of a spongy or powdery substance beneath the scales which raises them more and more, until they are nearly perpendicular with the surface and are easily detached. In the most severe cases the joints become inflamed, the birds are lame and scarcely able to walk, a joint or an entire toe may be lost, and the birds, unable to search for food, lose flesh and die from hunger and exhaustion.

Treatment.—Wash and brush the legs with soap and warm water, removing the loose scales that come off without causing bleeding. Dry the legs and apply a coating of balsam of Peru or an ointment containing 2 per cent of carbolic acid. A remedy highly recommended is made by mixing 1 part of oil of caraway with 5 parts of vaseline. When large numbers of fowls are to be treated, some poultrymen make a mixture of one-half pint kerosene and 1 pint raw linseed oil in a quart can, take this to the poultry house at night, and dip both legs of each affected bird into the mixture, allowing them to drip into the can for a minute after removal, and then replacing on the roost. The feathers of the leg must not be wet, as this causes irritation and sometimes burns the skin. The treatment should be repeated in three or four days.

CROP BOUND, IMPACTED CROP.

This is an overdistended and paralyzed condition of the crop, generally caused by overeating or by swallowing coarse and indigestible substances, such as feathers. In cholera the crop is paralyzed as a result of the disease.

Symptoms.—The first symptom is a loss of appetite or an effort of the bird to swallow without being able to do so. The crop is seen to be very large and much distended with contents which are more or less firmly packed together. If permitted to continue, the condition becomes aggravated, the breathing difficult, and death may result.

Treatment.—The contents of the crop may sometimes be removed by forcing the bird to swallow a teaspoonful or more of sweet oil, then massaging the lower part of the gullet, if it contains food, or, if not, the part of the crop nearest to the gullet, until a part of the contents are softened and may be pressed toward the head. This is made easier by holding the bird head downward. By continued manipula-

tion the greater part of the material may be removed. The bird should not be permitted to eat for several hours after it is relieved.

If this plan of treatment is not successful, the crop must be opened with a sharp knife and the contents removed through the opening, using for this purpose a coffee spoon, a button hook, small forceps, a bent wire, or other suitable instrument. After this is done, wash out the crop with clean, warm water. The opening should not be over an inch in length and should be closed with 3 or 4 stitches first in the wall of the crop and when this is finished an equal number in the skin. Each stitch should be made and tied separately. Coarse white silk is the best material, but if it is not at hand ordinary cotton thread may be used.

Feed on milk and raw egg beaten together for a day or two, and gradually change to soft mash.

INFLAMMATION OF THE STOMACH OR INTESTINES.

This trouble, when not the result of one of the contagious diseases to which reference has been made, is generally due to eating moldy or putrid food or irritating mineral poisons. It is indicated by loss of appetite, dullness, and constipation or diarrhea. It may be treated by giving 30 or 40 grains of Epsom salts or 2 teaspoonfuls of castor oil, and feeding a soft mash for a day or two.

LIMBERNECK.

The condition known as "limberneck" is in reality not a disease but is a symptom of several diseases which are characterized by a paralysis of the muscles of the neck, which makes it impossible for the bird to raise its head from the ground. This condition is due to the absorption of poisons from the intestines, which act upon the nervous system and cause paralysis. It is generally associated with indigestion, or the eating of moldy grain or putrid meat or with intestinal worms. The best treatment is to give a full dose of purgative medicine; that is, 50 or 60 grains of Epsom salts or 3 or 4 teaspoonfuls of castor oil for a grown fowl. Often the birds will be cured within 24 hours, and in case they are not better within 3 or 4 days it is not advisable to keep them.

LIVER DISEASE.

When not produced as the result of one of the contagious diseases described elsewhere, liver disease is generally caused by errors of feeding and lack of exercise. It can not certainly be distinguished from other forms of disease during the life of the bird. When examined after death the liver is found enlarged and so tender that it is easily torn. If it is suspected that other birds in the flock are similarly affected, correct the ration, give plenty of green feed, and encourage exercise in the open air.

530